HIGH 86 LOW 74
Thunderstorms likely
Weather, B-8



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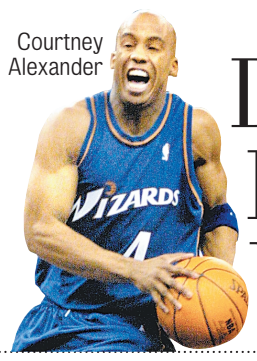
LIVING

**HEALTHY HOPE**

Doctor, patients search for sickle cell cure



Courtney Alexander

SPORTS

# DRAFT-DODGING HORNETS PICK UP WIZARDS GUARD

MONEY

**SHIPS AHOY**

Avondale, Ingalls to share in $17 billion Coast Guard pact



The Times-Picayune

A/B
50 CENTS 166th year No. 154
WEDNESDAY, JUNE 26, 2002
NEW ORLEANS EDITION

# Company discloses evidence of fraud

*WorldCom case likely among biggest ever*

**By Timothy Brown**
Associated Press

JACKSON, MISS. — An investigation by WorldCom Inc.'s board of directors uncovered nearly $3.8 billion in disguised expenses, the company said Tuesday, revealing what appears to be among the largest cases ever of accounting fraud.

**TELECOM SCANDAL**

▶ WorldCom Inc., based in Jackson, Miss., is the nation's second largest long-distance provider.
▶ Scott Sullivan, WorldCom's chief financial officer, has been fired.

Source: AP

WorldCom's chief financial officer, Scott Sullivan, who also is a director, has been fired, the company said, and senior vice president and controller David Myers resigned.

More than $3 billion of expenses in 2001 and $797 million for the first quarter of 2002 were wrongly listed on company books as capital expenses, the company said, and thus not reflected in its earnings results. It will restate earnings for all of 2001 and the first quarter of

*See* **FRAUD,** *A-11*

▶ **Stock indexes fall to new lows for year, Money**

# Nagin's staff plans run into obstacles

*Controversy brews on Singleton post*

**By Stephanie Grace and Gordon Russell**
Staff writers

Mayor Ray Nagin's effort to raise salaries substantially for some top City Hall jobs and create a handful of new positions, including a six-figure post for former City Councilman Jim Singleton, is encountering turbulence on several fronts.

In the first big bump for the nascent administration, both the council and the Civil Service Commission have delayed action on the jobs, some of which require approval from both bodies and some of which require just the council's blessing. Raising salaries of top administrators while reducing the overall size of a reorganized City Hall staff were two key planks in Nagin's campaign.

It's not clear how much of the resistance reflects a routine yearning for more details of the

*See* **JOBS,** *A-10*

Washing away

How south Louisiana is growing more vulnerable to a catastrophic hurricane

PART FOUR OF A FIVE-PART SERIES

Across the country, development is accelerating in the path of hurricanes, floods, wildfires and earthquakes. **It's a multibillion-dollar recipe for catastrophe.**

# Tempting fate


AP FILE PHOTOS

**Stories by John McQuaid and Mark Schleifstein** Staff writers
**Photos by Ellis Lucia** Staff photographer

HURRICANE Andrew was a turning point in the modern history of natural disasters. In August 1992 the storm tore apart hundreds of houses in Homestead, Fla., leaving nothing but splintered beams and rubble across dozens of city blocks.

Andrew survived its first landfall, grew stronger and pummeled the small bayou communities and oil and gas rigs of Louisiana's Atchafalaya Basin.

Florida and Louisiana had seen big storms come and go. But as insurers and government officials tallied the numbers in the following days and weeks, Andrew's most significant feature emerged: It had broken all U.S. records for disaster damage. The mounting toll in cleanup costs, wrecked property and lost business eventually hit $30 billion.

The number crunchers were shocked at first. Most had never imagined such a total was possible. But in 1994 the record was quickly shattered by an earthquake that jolted Northridge, Calif., causing losses ultimately estimated at $44 billion.

And it could have been a lot worse.

*See* **DISASTER,** *A-12*

**INSIDE**

**NATURE'S REVENGE •** Without advance warnings, thousands of people often died in natural disasters. **SEE A-13**

**SHIFTING TIDES •** The Corps of Engineers keeps Louisiana livable but has increased flood risk. **SEE A-14**

**MODEL SOLUTIONS •** Modeling software helps design levees, plot evacuations and plan relief efforts. **SEE A-15**

**THURSDAY**

**COST OF SURVIVAL •** New Orleans will continue sinking, and hurricanes will continue threatening us. But efforts to rebuild the area's natural coastal protections are showing promise.

MIDEAST IN CRISIS

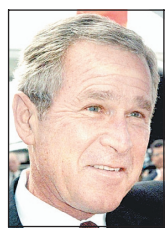
# Arafat, suicide attack linked

*Intelligence reports left Bush no choice*

**By Todd S. Purdum and Patrick E. Tyler**
© 2002, The New York Times

WASHINGTON — President Bush decided to call for Yasser Arafat's removal after receiving intelligence information last week showing that the Palestinian leader authorized a $20,000 payment to a group that claimed responsibility for the most recent suicide attack in Jerusalem, senior administration officials said Tuesday.

As a result, the officials said, the aggressive diplomacy that had originally been expected to follow the president's speech, including an immediate trip to the region by Secretary of State Colin Powell and a Middle East peace conference, will be delayed. Instead, officials acknowledged Tuesday that they will need a new round of consultations before deciding on their next steps.



**President Bush** Some Arab leaders ignored his speech's emphasis on replacing Palestinian leadership

Although Arab leaders said Bush's call for Arafat's removal caught them by surprise, most simply chose to ignore the speech's emphasis on replacing the Palestinian leader. Instead, they offered constructive and cautiously supportive public comments.

Privately, however, they said they are pressing for clarifications on the next steps, including how quickly the administration will urge Israel to withdraw its military forces from the West Bank and Gaza so the process of Palestinian security and government reforms can begin.

An unresolved question that has complicated any short-term plan for travel by Powell is Arafat's status between now and

*See* **MIDEAST,** *A-7*

▶ **Arafat says Palestinians will decide his fate, A-8**
▶ **Israeli troops lock down seven towns, A-9**

AP PHOTO

**HOT AND HEAVY**

While President Bush was declaring Arizona a disaster area, hot weather and shifting wind in Colorado made it another miserable day for firefighters near Durango, as new flames flared near the main blaze Tuesday. **See story, A-5**

# Flood projects get new life

*Corps shifting money for Orleans, Jeff work*

**By Bruce Alpert**
Washington bureau

WASHINGTON — The Army Corps of Engineers shifted $7.1 million Tuesday to keep work going on flood-control projects in Orleans and Jefferson parishes through the end of July, and Louisiana lawmakers said they will push for congressional approval of another $8 million to cover the rest of the fiscal year.

The money was moved to the 17 projects in the Southeast Louisiana Flood Control program at the request of members of the state's congressional delegation, including Sens. Mary Landrieu and John Breaux, both Democrats, and Reps. William Jefferson, D-New Orleans, and David Vitter, R-Metairie.

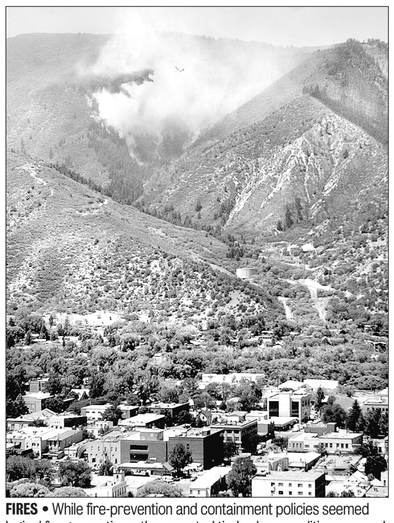
Landrieu said the $7.1 million was borrowed from other corps projects that are unlikely to need the money before the federal fiscal year ends Sept. 30.

A budget shortfall, blamed partly on the redirection of fed-

*See* **PROJECTS,** *A-11*

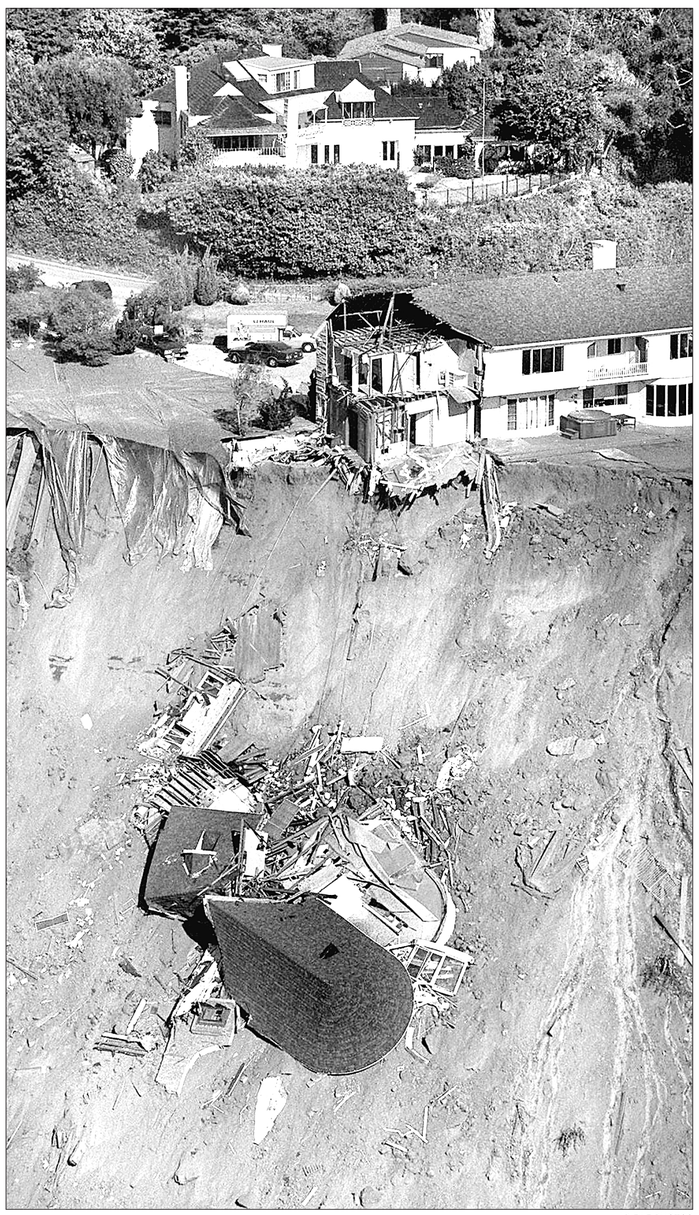
*As more people move into coastal areas, flood plains, mountainous regions and remote wooded areas, man grows more vulnerable to Mother Nature. As development expands and natural protections are interrupted, the potential for destruction grows.*

# DANGER ZONES



**FIRES** • While fire-prevention and containment policies seemed logical for generations, they created tinder-box conditions around many communities in the West. Fires currently burning in Colorado and Arizona have already destroyed more than 600 homes, including about 30 in Glenwood Springs, Colo., above.

**COASTAL EROSION** • Along coastal areas, constant battering by the ocean or Gulf can undercut the foundations of homes, such as here in 1998 at Broad Beach in Malibu, Calif. Several houses have collapsed in the area because of the strong surf along the beach.



AP FILE PHOTOS

**LANDSLIDES** • Cliffside homes may offer unparalleled views, but fault lines running throughout California can turn a dream home into a nightmare. On Jan. 17, 1994, the Northridge earthquake in Los Angeles triggered landslides that blocked roads, damaged water lines and destroyed many homes, such as this one in the Pacific Palisades area.

**FLOODS** • The Mississippi Gulf Coast's casino row faces destruction in the event of a direct hit by a hurricane. Mississippi state law requires casino ships to sail out to sea if a hurricane threatens, while barge casinos are required to have moorings capable of withstanding a Category 4 hurricane. In a Category 5 hurricane, some casinos in the area plan to sink the barges on which they are built.

## More people at risk than ever before

**DISASTER,** *from A-1*

Both disasters hit relatively confined geographical areas in suburbs, sparing the large cities — Miami and Los Angeles — just miles away. Relatively few people died: 57 in the quake, 61 in the hurricane.

The earthquake was a moderate magnitude 6.7 on the Richter scale and lasted 15 seconds. Andrew was a powerful Category 4 storm, but it was moving fast and crossed inhabited areas of south Florida in minutes. By the time it hit a sparsely populated section of Louisiana, it had weakened considerably and was still moving fast, so it caused relatively little damage here.

Andrew and the Northridge quake opened a new era in which the United States will see such megadisasters become commonplace, emergency managers and experts say.

Because of population growth and a massive expansion of settlement into high-risk areas in the past generation, more people and more communities than ever are on the precipice of destruction. The wildfires burning across Colorado and Arizona in the past two weeks are just the latest example of this growing problem.

"History shows that the catastrophes we have had have become larger and larger," Federal Emergency Management Agency director Joe Allbaugh said. "It's due to development along the coast, increasing populations across the board. We have problems now with fires in the West. Traditionally the fire season doesn't start till summer. This time it started in January. . . . So we need to be in the business of preparing."

Development itself is making places more vulnerable to disaster. As people have tried to tame nature by building homes, redirecting water, suppressing fires and reshaping coastlines, they have disrupted or blocked natural processes. But you can't just lock nature in place, and these measures have accelerated cycles of destruction in unpredictable and dangerous ways.

"There's a tendency to see these events as chiefly the result of natural forces beyond human control," said Ted Steinberg, an environmental historian at Cleveland's Case Western Reserve University and author of "Acts of God," a book on disasters. "And obviously a tornado is a physical phenomenon. But what's disastrous about these events is that to a certain extent they're within human control because of policies we put into effect. We have a situation where natural forces lead to calamitous consequences that might otherwise be avoided."

In the wake of the Sept. 11 terrorist attacks, which helped send the federal budget spiraling into deficit, these trends raise questions about how the federal government will shoulder the costs of recovery from future natural disasters if they regularly rise into the billions. Some states and local governments are taking a more aggressive stance in disaster prevention, and emergency managers say the trend is catching on. The changes could mean more costs for the New Orleans area, which depends heavily on federal programs to protect it.

For 300 years, people have worked to tame a vast, diverse and dangerous American landscape for settlement and safety — often at the cost of lives and property when nature suddenly struck back.

A hugely powerful sequence of three earthquakes in 1811 and 1812 on the New Madrid fault running through the Midwest and South probably measured more than 8.0 on the Richter scale and was felt across the continent. But the earthquakes did little structural damage because there wasn't much to knock down. If a similar quake struck today, it would devastate St. Louis, Memphis and other large cities.

As the U.S. population increased, death tolls rose and damage worsened. When a hurricane hit Galveston, Texas, in 1900, the storm surge killed at least 8,000 people, 22 percent of the population of 35,000. More than half of Galveston's buildings were destroyed. The 1906 San Francisco earthquake measured between 7.7 and 7.9 on the Richter scale. The quake and subsequent fire killed more than 3,000 people out of a population of 400,000 and leveled portions of the city.

The 1927 Mississippi River flood inundated 27,000 square miles of the Midwest and South with water up to 30 feet deep. Although much of the flooded area was farmland, the water washed away 2,200 buildings and damaged thousands more. Early estimates put the death toll at 250, but some historians now say it was more than 1,000. About 700,000 people were left homeless in an event that prompted the federal government to launch major flood-control efforts along the river.

For the balance of the 20th century, the nation benefited from the innovations spawned by the industrial and electronic revolutions. Death tolls fell as building techniques and weather prediction improved and local governments developed ever more sophisticated civil defense and evacuation plans and the means to broadcast them.

Hurricanes, flooding, fires and earthquakes left their marks, but they have never surpassed the modern megadisasters that have taken place abroad. Hurricane Mitch, for example, struck Central America in 1998, killing more than 9,000 people and leaving more than 2 million homeless. The 1976 earthquake that leveled the entire city of Tangshan, China, killed more than 250,000.

But U.S. natural disasters have recently taken a dramatic turn for the worse. Though death tolls have remained low, the physical scale of destruction and its costs have shot upward. In the United States, for example, the total cost of all natural disasters averaged $10 billion annually from 1975-1989, according to a 2002 National Academy of Sciences report. But during 1990-1998, the figure climbed to $17.2 billion.

That means federal, state and local expenditures for preparation, cleanup and rebuilding are rising. The insurance industry has fretted and retrenched several times, cracking down on consumers each time, most recently after Sept. 11. Government policies and programs that once worked are breaking down or backfiring.

### Landscape of risk

Louisiana is just one place where these trends have converged: Development and man-made alterations in the landscape have reduced natural protections such as wetlands. That process has outpaced the ability of governments to build new disaster protection such as levees and flood-control systems and to plan efficient evacuation routes.

These changes are shaping a landscape of risk across the United States, from the hurricane- and flood-prone Gulf and south Atlantic coasts to the annual ritual of wildfire evacuations in the West to the vast suburban areas on the West Coast vulnerable to earthquakes.

With an explosion of coastal development in the past generation, there are now more people living within a mile of a coastline than at any point in the past. In 1960, an average of 187 people were living on each square mile of U.S. coast, excluding Alaska. This population density increased to 273 per square mile by 1994 and is expected to reach 327 by 2015.

This trend puts more people in the path of hurricane winds and flooding. It also has made it harder to design evacuation routes that funnel large populations away from the coast quickly, as New Orleans area residents learned in 1998, when about 325,000 people fought traffic jams to get out ahead of Hurricane Georges.

> Though death tolls have remained low, the physical scale of destruction and its costs have shot upward. In the United States, for example, the total cost of all natural disasters averaged $10 billion annually from 1975-1989, according to the National Academy of Sciences. But during 1990-1998, the figure climbed to $17.2 billion.

Development has worsened erosion of beaches all along the coast, creating a slow but steady march of the sea inland, exposing more structures to hurricane-force winds and flooding.

Inland, a similar dynamic has put more people in the path of more common flooding from rainstorms and rivers overflowing. Most cities lack the elaborate flood-protection system that the New Orleans area has — levees, pumping stations, canals to route water out of town — but many have accelerated development in and around flood plains without considering the consequences.

"Floods are not necessarily a harmful thing until humans build something in the way," said Larry Larson, executive director of the National Association of State Floodplain Managers. "Flood losses are not going down, they're going up because we're building too many structures at risk. We don't think of how development may change flooding dynamics. Today's flood level is not tomorrow's flood level. Changing the farm field or forest into a parking lot changes the runoff, and often that's not taken into account."

### Fire plays important role

Every year, dangerous fires threaten and sometimes destroy communities that abut wilderness areas. Like hurricane warnings, evacuating from areas threatened by wildfires has become something of an annual ritual. This year's fires have already outpaced the record-setting 2000 season in acres burned. Fires currently burning in eastern Arizona and Colorado have destroyed close to 600 homes. Two years ago a wildfire sparked by accident during a controlled burn swept through part of Los Alamos, N.M., gutting 235 homes.

Fire plays an important role in the ecology of forest areas. It clears out deadwood and old trees, letting more light hit younger trees and reach the forest floor. Most unspoiled forests have a "fire regime" — a cycle lasting anywhere from a year to a decade or longer — in which flames return at regular intervals.

Improved firefighting capabilities, the need to exploit forests for lumber and the wish for safety led to a decades-long policy of suppressing fires on all federal lands in the West. The practice became routine on private lands as well. A denser, overgrown forest is a greater risk for wildfires. As a result, the rapidly-expanding borderland between suburbs and woods is turning into a tinderbox.

Earthquakes pose a problem distinct from other kinds of disasters. The risk is spread over much wider areas, and quakes are virtually unpredictable until seconds before they hit. Human activities do not contribute directly to the likelihood or intensity of a quake, but they do determine how much damage will occur.

Earthquake specialists say that communities generally underestimate their long-term earthquake risks and do little to prepare. There are good building codes, but few incentives for smaller cities and communities to adopt them. In larger cities, older housing stock typically doesn't meet current codes. So in many vulnerable spots, codes effectively don't exist.

Building codes are also designed primarily to keep buildings from collapsing on people, not to minimize damage.

"Building codes are designed to protect life safety," said Susan Tubbesing, executive director of the Earthquake Engineering Research Institute in Oakland, Calif. "That is really quite a low level, and unfortunately people take that as the upper rather than the lower bound."

Mounting losses and risks have handed the federal government an ever-growing responsibility for mopping up in what some worry will be a growing drain on federal resources.

In the first half of the 20th century, the U.S. government had virtually no role in disaster relief. When a hurricane struck Miami in 1926, it caused more than $40 billion in damage in today's dollars. The federal government did nothing. In the postwar boom Congress passed the Disaster Relief Act of 1950, which provided postdisaster payments to local governments. Then as the scale of disasters grew and the federal government assumed a more prominent role in American life, it took on a central role.

Under the 1988 Robert T. Stafford Disaster Relief and Emergency Assistance Act, the law that defines the current federal and state roles in disaster relief, the federal government is secondary to states. But states and localities don't have the resources to cope as the scale of disasters grows.

"It's supposed to be a backup, but the whole notion of a backup has gone away," said Mary Comerio, a professor of architecture at the University of California, Berkeley, and author of a book on disaster reconstruction policy.

State officials still officially run the show after a disaster strikes, but it's the federal programs that make a difference. The Federal Emergency Management Agency, or FEMA, coordinates the response of federal agencies during and after a disaster, and it distributes money and loans for rebuilding in the weeks and months afterward.

### Requests for aid rising

As disasters became more a focal point of national attention, of cable news and the Weather Channel, disaster response became increasingly popular — and politicized.

During the 1990s, the Clinton

*See* **DISASTER,** *A-16*

Wed, Jun 26, 2002 10:15 AM 06.26a1.hurricane



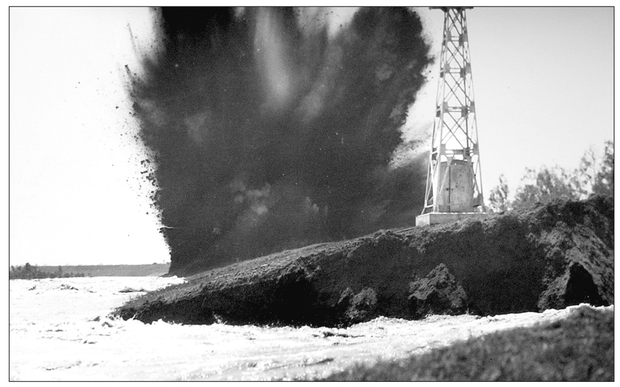


*Today, warning systems and stronger building codes in disaster-prone areas have greatly reduced the number of deaths from natural disasters, although property damage has skyrocketed as development accelerates. A century ago, however, property damage – while significant – was nowhere near as catastrophic as the casualty count.*

# NATURE'S REVENGE

**1900 GALVESTON HURRICANE** • In 1900, the most deadly hurricane in U.S. history hit Galveston, Texas, head on. The 15-foot storm surge on Sept. 9 devastated the city, killing at least 8,000 people – nearly a quarter of the city's population. Throughout the city, piles of unrecognizable debris stood where half the city's buildings had been standing.

**1906 SAN FRANCISCO EARTHQUAKE** • The 1906 earthquake stands as the deadliest earthquake in U.S. history. The quake and subsequent fire killed more than 3,000 people and flattened portions of the city. Violent shaking during the biggest tremor lasted 45 to 60 seconds. The quake was felt from southern Oregon to below Los Angeles and as far inland as central Nevada.

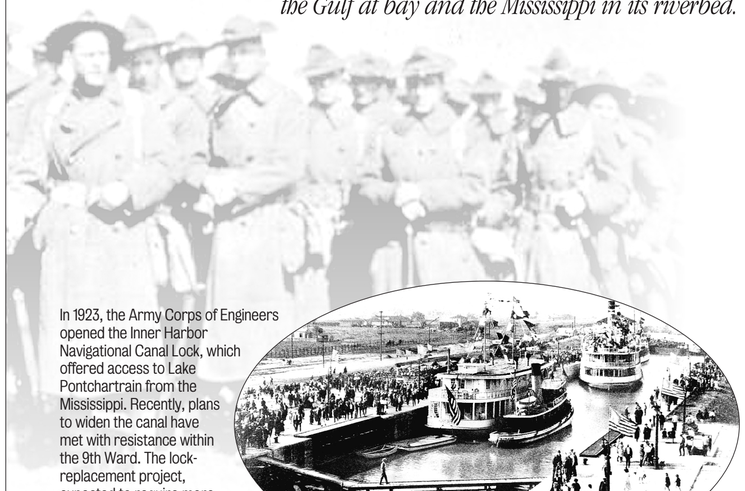


**1927 MISSISSIPPI RIVER FLOOD** • The flood inundated 27,000 square miles, killed as many as 1,000 people and left an estimated 700,000 homeless. City leaders feared New Orleans could not survive the oncoming flood, so the river levee at Caernarvon was dynamited on April 29, 1927. Floodwaters gushed into St. Bernard and Plaquemines parishes for months. Destruction across the country from the flooding led to major river- and flood-control projects.

# Shifting tides

No one has been more responsible for keeping Louisiana habitable over the past 200 years than the Army Corps of Engineers. **But the corps has also caused the most problems.**

*Since the 1830s, when its mission expanded to include civil works such as flood control, the Army Corps of Engineers in Louisiana has almost single-handedly been responsible for keeping the Gulf at bay and the Mississippi in its riverbed.*





In 1923, the Army Corps of Engineers opened the Inner Harbor Navigational Canal Lock, which offered access to Lake Pontchartrain from the Mississippi. Recently, plans to widen the canal have met with resistance within the 9th Ward. The lock-replacement project, expected to require more than 10 years, would involve replacing bridges at St. Claude, Claiborne and Florida avenues and demolishing the Galvez Street wharf.

The Caernarvon Freshwater Diversion Project is one of the corps' recent efforts to repair damage caused by earlier flood-control projects. The structure aims to restore former ecological conditions of Breton Sound by diverting fresh water from the Mississippi into the coastal bays and marshes of Plaquemines Parish.

STAFF PHOTO BY ELLIS LUCIA

In 1966, the Army Corps of Engineers undertook a project to stabilize the riverbank near the French Quarter. The concrete revetment was part of an attempt to keep in check the river's natural inclination to meander.

STAFF FILE PHOTO

By John McQuaid and Mark Schleifstein
Staff writers

THE Army Corps of Engineers says it has a big fix for the subsiding and eroding coastal areas that are threatened by increased storm-surge flooding. When completed in 15 years, it will be a cutting-edge achievement in hurricane-protection engineering: a 9- to 15-foot levee with an unusual, environmentally friendly design snaking for 72 miles across marshes and along bayous through towns from Houma to Larose.

The $680 million Morganza-to-the-Gulf of Mexico hurricane levee is part of an ambitious array of hurricane-protection projects the corps has planned or under way as it tries to hold off the rising waters of the Gulf. From big cities such as New Orleans to tiny marsh communities such as Dulac, hundreds of thousands of residents depend on the corps' engineering know-how to protect them from devastating floods.

But the levee also embodies many of the pitfalls of corps projects. Another huge structure will be built on top of sensitive marshes. Its big innovation — a design to let water flow back and forth through gates to preserve wetlands — is untested. And no one is yet sure how to integrate it with planned coastal restoration projects.

Hurricane risks are on the rise here because natural storm protections such as wetlands and barrier islands are disappearing. And for 200 years the corps — with its propensity to build large projects that hurt marshlands — has unintentionally contributed more to the deterioration of those protections than any other agency, public or private.

Now the corps is in charge of fixing many of the problems it created, and officials plan to use many of the same techniques they always have.

If current plans to restore the coast get a green light, the corps will have a central role in building levees, locks and floodgates and in maintaining and rebuilding wide areas of marshlands and barrier islands all at the same time. Its record raises a central question: Can the corps learn from mistakes and protect the region from hurricanes, or might it end up making a bad situation worse?

## Protections foster erosion

Since the early 1800s, the corps has designed, built and maintained the massive public works projects that make modern New Orleans and south Louisiana possible.

The corps created the deep-draft Mississippi River channel that helps the Port of New Orleans serve as the nation's largest handler of bulk cargo. The corps raised key levees that protect the city and development along the river from spring flooding, tropical storms and hurricanes. The corps also built and permitted the navigation channels for an expanding oil and gas industry that has underwritten the state's economy for decades.

But depending on what scientist you talk to, these projects also are responsible for a third to more than half of the erosion that has occurred along Louisiana's coast in the past 100 years, when more than 1 million acres of Louisiana's coast, mostly wetlands, have eroded — an area the size of Rhode Island. The rate of loss grew slowly to about 14 square miles a year in the early 1940s, then increased rapidly to a high of 42 square miles in the late 1960s before slowing to between 25 and 35 square miles a year today.

As a result, the corps' own hurricane protection levees have become more vulnerable. They were built with the understanding that they would be buffered from winds and storm surge by 40 to 50 miles of protective swamp and marsh, corps and state officials say. But today the Gulf has moved north, threatening the levees and the communities they protect with higher storm surges and stronger wind-driven waves.

"The leveeing and controlling of the Mississippi River for flood protection and navigation improvements for the last 125 years is an example of the things (the corps) can do," said Clifford Smith, chief executive officer of T. Baker Smith & Co., a coastal engineering firm in Houma. "But it's also an example of how some of the problems developed in south Louisiana."

## Progress exacts costs

The projects that make living here viable have backfired in a variety of ways:

▶ The Mississippi River channel carries millions of tons a year of sediment off into the deep waters of the Gulf instead of into the natural channels that would build up and expand the bird's-foot delta and barrier islands at the river's mouth. Without sediment to replenish them, the wetlands that serve as a buffer against the winds and waves pushed ashore by storms and hurricanes disappear.

▶ The Old River Control Structure in Simmesport stops the river from changing its course to follow the path of the Atchafalaya River, and a dam built at the turn of the 20th century blocks Mississippi River water and sediment from traveling down Bayou Lafourche. Both stop the river's natural tendency to move like a hose back and forth along the coastline, building new wetlands and restoring the coast.

▶ Navigation channels such as the Mississippi River-Gulf Outlet, the Gulf Intracoastal Waterway and oil-field canals let wetlands-destroying saltwater from the Gulf reach farther and farther inland. Ships using the channels have eroded their banks and surrounding wetlands, and the channels provide faster pathways for hurricane storm surges.

Combined with the natural sinking of sediments underlying the remaining wetlands, managing the Mississippi River delta for humans has turned vast expanses of marsh and swamp into open water, and the damage is continuing.

"Even the corps (engineers) will acknowledge that were they to design and build the Mississippi River and Tributaries Project today, it would be done in a manner that recognized the importance of the unintended effects of these projects," said Randy Hanchey, a former corps engineer who now directs Louisiana's coastal restoration program as deputy secretary of the state Department of Natural Resources.

But, he said, blaming the corps is simplistic. "One needs to keep in mind that all these projects, including the MR-GO, and certainly including all the levees, were projects that the state of Louisiana and local communities lobbied for, fought for and supported for years," Hanchey said. "The corps doesn't build projects that people don't want. If it's been a mistake, it's a mistake we all made."

Now, after decades of manhandling nature, corps officials say they have learned a lesson and are changing their attitude. They want to fix some of the damage by restoring part of the Mississippi River's natural functions and rebuilding the coast.

"Our mission set has changed in response to what the American people wanted us to do," said Lt. Gen. Robert Flowers, chief engineer of the corps. "In the 1930s and 1940s, when large public works projects were deemed necessary to stimulate the economy, stimulate development, recover from war, provide jobs, that's what the corps executed. In the past the corps' thrust was to view projects in isolation. Today we see environmental restoration as a growing part of our mission set."

With concern rising among scientists and political leaders over the plight of south Louisiana, the corps is pursuing two goals simultaneously: It is expanding hurricane levee protection southward toward the Gulf and in New Orleans-area suburbs with projects that would cost at least $2.5 billion if all are eventually built. It also is examining whether the levees surrounding the east bank of New Orleans and Jefferson Parish should be raised.

At the same time, the corps would play a leading role in ambitious state plans to restore the coast that are still awaiting congressional approval. The $14 billion, 30-year blueprint includes construction of new barrier islands and refurbishment of old ones, as well as massive structures built into levees to reroute as much as a third of the Mississippi River's water and sediment to restore coastal wetlands.

## Forging a new vision

The corps' mission in Louisiana is evolving at a time when the agency is under fire from an array of environmental groups, scientists and some members of Congress. Environmentalists say the corps has paid inadequate attention to the ecological effects of some of its large projects. Budget hawks say the corps spends too much for questionable results. Some critics are calling for wholesale changes in how the agency operates, massive budget cutbacks or both, which corps officials have resisted.

Flowers said the corps must weigh many different interests, some of which will inevitably conflict, and do so fairly. "I hate to hear comments describing the corps as an agency that's insensitive to the environment. That's not true," he said. "We're an agency whose rules require us to look at all aspects of the project: economic, environment, social effects, property rights, you name it. We have to take all facets into consideration in making our recommendations."

Though they still harbor complaints about some corps projects, most environmental groups say the agency has been moving in the right direction in Louisiana.

"The corps has slowly come around to looking at projects holistically, but they're not there yet," said Kate Costenbader, coordinator of the National Wildlife Federation's Greening the Corps campaign. "With flooding in particular, they've taken one community and built a flood-protection levee or a dam, and when it was done, found that they've decreased the space for water to go, so they increased flooding downstream."

Critics say the corps must do more than build walls and structures. It must take into account how those big construction projects alter the complex life of the coast: ecological relationships, the seasonal dynamics of erosion, the aftereffects of storms. The corps has not traditionally cultivated such expertise in its engineers.

"The question that has been asked in the past has been how to manage the river for navigation and flood control, what to do to facilitate oil and gas production on- and offshore, and how to bring natural gas onshore," said Jim Tripp, chief counsel for Environmental Defense, a national environmental organization, and a member of the Governor's Committee on the Future of Coastal Louisiana. "But now there's a new variable: How do we do all these things in a manner compatible with comprehensive deltaic restoration?"

Other agencies that can act as a counterweight to the corps should participate in new projects to ensure that past mistakes aren't repeated, critics say.

"You have to have checks and balances built in," said Fred Weinmann, a former Environmental Protection Agency biologist who sits on a national corps' environmental advisory committee.

"I don't think the corps is the wrong agency to do the work, but it may not always be the right agency to make decisions," he said. "You've got to have people from outside the agency who know what they're doing involved in the design of these projects, and then you have to have them stay involved during construction."

## EPA eyes Morganza levee

The Morganza-to-the-Gulf levee reflects many of those tensions. The corps usually builds hurricane levees at the edges of settled areas. But the Morganza levee would enclose a half-dozen scattered small towns along bayous, and some of it would be built across marshes. That's a potential problem because marshes depend on the daily flux of tides to sustain their web of life. Cut that off, and wetlands inside the levee may die.

To compensate, the corps created designs for a "leaky levee." The project will have nine 56-foot-wide gates, three larger floodgates and a dozen 6-foot-by-6-foot culverts that will be closed only during floods. They will let water — and fish — flow through the levee into the marshes behind it and flow out again. Corps scientists think the structures will protect marshes from storm damage and coastal erosion.

Scientists who have reviewed the design are cautiously optimistic about the project. "The folks down there need hurricane protection, and the corps has made a legitimate effort to provide it, one that recognizes the need to protect wetlands," said John Ettinger, a scientist in the Environmental Protection Agency's water quality protection division who drafted EPA comments on the proposal.

But the EPA cited several potential problems it says must be closely watched, especially how the altered water flow through the levees will affect wetlands behind them.

For example, ponds could be created on the inside of the levee. Without adequate pumps in place, that could hurt wetlands and accelerate their demise. "EPA's position is whenever you alter the hydrologic regime of a wetland, more likely than not it will not recover," Ettinger said.

The biggest imponderable is how engineers will simultaneously coordinate coastal restoration with levee building over decades.

Coastal restoration projects will depend in part on building structures that divert water and silt from the Mississippi River and direct them across marshes. The diversions will deposit silt and push the saltwater south, rebuilding the land and reversing some of the damage done by saltwater intrusion. But building levees across marshes may interfere with that process.

Corps watchers also worry about the uncertainties of timing and money. It often takes decades from the time corps projects are proposed until their completion. Budgeting problems could delay or halt some projects even after they are begun.

Bush administration officials have said they want to restrain corps spending, and agency administrator Mike Parker was forced to resign this year after he criticized the idea of cutting back. Budget shortfalls this year have left the corps scrambling to find money to continue building unfinished flood control projects in New Orleans and Jefferson Parish.

"Time is our enemy," said Smith, the Houma engineer who sits on the Mississippi River Commission and also is a member of the governor's coastal task force. "The more time that's spent studying and getting projects approved and funded, the bigger the problems we have."

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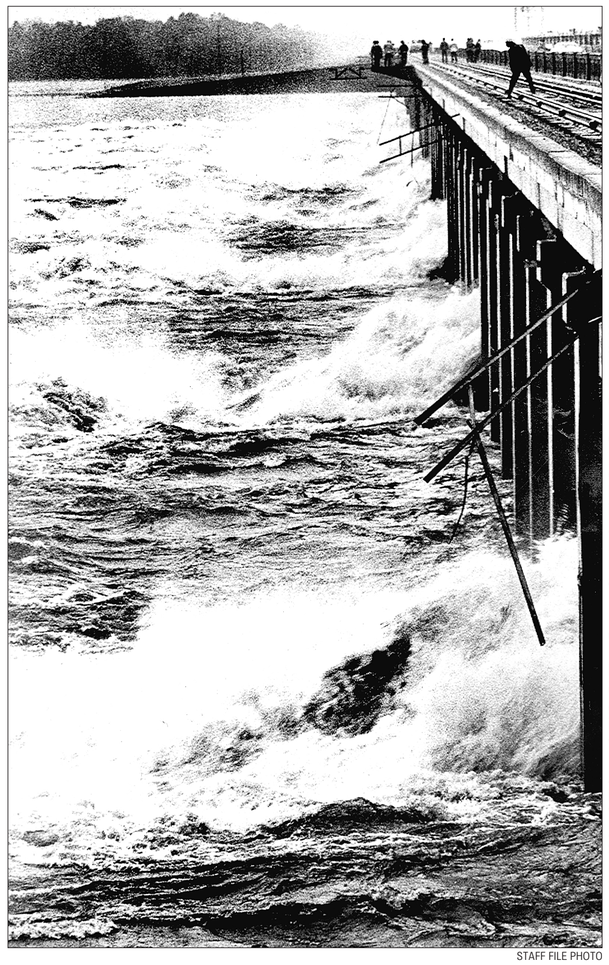
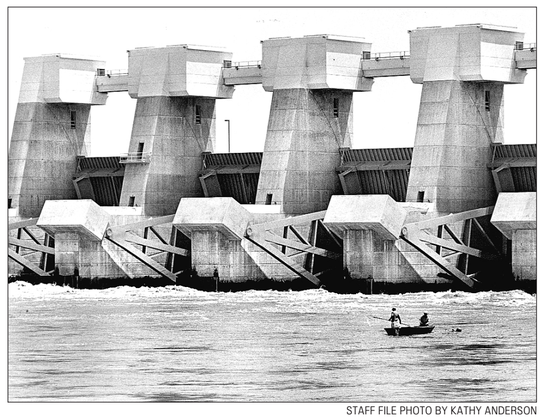
# RIVER'S MASTERS



The Morganza Spillway, seen here in 1973, in Point Coupee Parish helps discharge floodwaters of the Mississippi into the Atchafalaya River. In a major flood, about half the floodwaters carried by the Mississippi can be diverted into four waterways: the Atchafalaya River, the West Atchafalaya Spillway, the Morganza Spillway and the Bonnet Carre Spillway.

STAFF FILE PHOTO



Perhaps the most important project the corps has tackled is the Old River Control Structure, which keeps the Mississippi from flowing down the path of the Atchafalaya River. The massive project was authorized by Congress in 1954, and an auxiliary structure, left, was completed in 1987 to divert 30 percent of the river into the Atchafalaya. Without the structures, an estimated 140,000 people would be displaced if the Mississippi changed course.

STAFF FILE PHOTO BY KATHY ANDERSON

**Powerful computers now can predict where flooding will occur and what damage to expect.** With that information, engineers can design better levees, and emergency preparedness officials can plan quicker evacuations and better relief efforts.

STAFF PHOTO BY ELLIS LUCIA

Greg Stone, a professor of geology at LSU's Coastal Studies Institute, uses a wave tank and sophisticated software to model the effects of waves, in hopes of devising new ways to protect marshes and barrier islands against erosion and ultimately reduce hurricane storm surge damage inland.

# Model solutions

By John McQuaid and Mark Schleifstein
Staff writers

AS Hurricane Georges shadowed the Gulf Coast 460 miles southeast of New Orleans early on a Friday morning in September 1998, Louisiana State University engineering professors Vibhas Aravamuthan and Joseph Suhayda huddled over a computer workstation in their campus office suite, sorting through terrifying scenarios of what the next few days might hold.

The National Weather Service had just issued its 5 a.m. advisory for Sept. 26, predicting that Georges, a Category 2 storm with winds of 105 mph, was expected to continue heading west-northwest at about 9 mph. The most likely track had it making landfall just to the east of New Orleans in less than 72 hours, a potentially devastating course that could flood large swaths of the metro area.

Aravamuthan plugged data on the likely track into a program running on his terminal that simulates hurricane storm surges. The professors waited for two hours as the computer crunched the numbers and finally displayed a rainbow-colored, pixelated map that showed where to expect high water. In the simulation, the flood rose and topped the levee at a low point where U.S. 61 crosses west out of Jefferson Parish, sending water pouring into protected areas. The map showed three quarters of the east bank of Jefferson and Orleans parishes ending up underwater.

Suhayda consulted with the state Office of Emergency Preparedness, the Army Corps of Engineers and officials in Jefferson Parish, who accelerated a planned sandbagging of the weak spot. Some corps officials decided to cancel their plans to leave the area so they could stay to monitor potential trouble spots in the levee system.

Georges ultimately veered to the east and the New Orleans area was largely spared, except for flooding in St. Bernard Parish. But the episode shows just one of the ways that computer modeling is changing and refining emergency response plans that once relied mostly on guesswork.

Mapping and modeling software have made it possible not just to forecast hurricane tracks but to predict how the storms interact with a landscape, to show where flooding and wind will strike and what damage they might do.

"It's had a huge effect," said Jay Baker, an associate professor of geology at the Florida State University who studies hurricane evacuations. "It's the foundation of all evacuation planning studies that take place now. It's night and day. It used to be a real guessing game: You evacuate from low-lying areas. Now it's modeling."

The advances in computing power let programs take many different factors — such as land elevations, wind speeds and ocean currents — superimpose them and predict how they will interact. Today, government agencies and private companies use an array of these.

The ultimate aim is to mimic reality as closely as possible. But different programs have different purposes. Some are complex, high-tech exercises that meticulously account for every bump in the landscape, and they can take many hours or days to run. Others, like the LSU model, can be run quickly to generate information as events unfold.

Local emergency preparedness agencies use SLOSH (Sea, Lake and Overland Surges from Hurricanes) and a related program called HurrEvac to design evacuation routes and manage evacuations as they occur. The Federal Emergency Management Agency uses a program similar to LSU's to calculate flood risk for insurance rates. The corps is using a model called AdCirc (Advanced Circulation Model for Coastal Ocean Hydrodynamics) to examine its levee designs. Insurance companies use models to estimate the risk of wind damage.

Having a way to simulate hurricane flooding is especially useful because hurricanes are relatively rare and idiosyncratic events. They move across the coast in unique ways, bringing floods, winds and rainfall along varying paths. A storm's strength is only one factor in flooding. Water heights change quickly depending on wind, the storm's track and the obstacles encountered. So there isn't a good historical record that would allow scientists to judge how often a place might be flooded or how the next big storm might affect a given locale.

Without modeling, government agencies would be left to trial and error: Build in response to past floods and wait for the next storm to hit to see whether they are right. With it, a modeler can draw a stretch of the coast and throw thousands of different storms at it from every possible direction to identify trouble spots.

The New Orleans area presents a unique problem for programmers. In most other places, the boundary between coast and sea is clear and the land rises above sea level relatively fast. But south Louisiana is flat with alternating areas of water and land. Much of the land, including heavily populated areas, is below sea level. Some places are surrounded by levees. The Mississippi River, smaller waterways and canals snake through the area.

"The whole way in which a storm evolves once it makes landfall is not as well-known as the behavior of storms on the open ocean," said

*See* **MODEL,** *A-16*

WASHING AWAY

# Models help predict risks, plan evacuations

**MODEL,** *from A-15*

Joannes Westerink, a University of Notre Dame engineer working on the AdCirc storm-surge model for the corps. "Yet there is no region in the country where that is more critical than Louisiana. You have Lake Pontchartrain that is able to nail New Orleans (from the north). Surge can propagate up the river, and surge can come in from southeast. It's a complex problem."

## Forecasting on the Web

So it's a big challenge to create software that mimics this landscape and shows how an enormous, hurricane-driven swell moves across it. Programs gauge the complex forces acting on the water column, such as wind and air pressure using basic equations that describe fluid dynamics.

Programmers must try to model the winds of an artificial hurricane so they match a real one. They must decide how wide an area to model. If the area is too small, the model won't depict the slow buildup of a surge on the open sea and will end up with inaccurate results on what occurs when the wave hits land.

Once a model is complete, scientists use "hindcasting" to make it conform to reality. They plug the parameters of a real storm into a model and compare the results with recorded storm-surge heights. If the numbers don't line up, then the program needs adjusting.

If a model works, many scenarios can be explored. The National Weather Service uses the SLOSH model to run parallel tracks of storms at various strengths across an entire area. It then puts them together in a map showing the high points for flooding from each category and speed of storm. Emergency planners can then see the worst case for flooding in, say, a Category 3 storm moving at a given speed. The areas deepest underwater get highest priority in evacuations.

The increasing power of personal computers means that models can be run in much shorter times than before — enough time to collect data, input it into a model and get a useful result as a storm approaches. The LSU engineers have been doing this since the mid-1990s, offering flood forecasts to local officials on the World Wide Web after every six-hour weather service track prediction.

Such information can be used to plan road closures, sandbagging efforts and evacuation management. "If there has been a major change in the way we deal with these things, it's in the short term. Hour by hour, we are able to factor in minor nuances and changes in direction of a storm," Jefferson Parish Office of Emergency Preparedness director Walter Maestri said. "And the way we use that information for short-term planning is if there's an area where for whatever reason people have not responded, we use it to move those folks out quickly."

Modelers can also take a real storm from the past and rerun it in today's landscape. Since the landscape is sinking and eroding and levees have been built or raised, storms from the past would produce different flooding patterns today. Designers can judge weak points in today's landscape and levee designs and plan for the future.

Though they may be looking at the same phenomenon, no two models are alike in the way they interpret the various forces at work in a storm surge. The differences depend on how the model was developed, how it depicts the intricacies of winds and water currents and its real-world purpose.

A recent SLOSH simulation shows Hurricane Betsy moving over a present-day New Orleans. As the storm hits, the model shows water rising along the levees on the south side of St. Bernard Parish and along the Intracoastal Waterway as it heads into New Orleans. Soon the water is pouring over the top of the levees at those two junctures and is spreading through Chalmette and eastern New Orleans. By the time the flood ends, water has reached depths of 5 feet in Chalmette and 8 feet in some parts of New Orleans.

But the corps says the levees would hold off another Betsy. They cite AdCirc model simulations that show Betsy hitting New Orleans today with no flooding inside the levees. AdCirc is considered the state of the art in storm-surge modeling in part because it can re-create the winds of historical hurricanes with some accuracy.

The SLOSH model is used to alert the public to flood threats and plan for worst-case situations. Typical SLOSH maps show the highest possible flooding over wide areas. But several modelers using other programs say SLOSH may overestimate flood levels.

"For Louisiana, SLOSH tends to give higher elevations than the FEMA model," Suhayda said. SLOSH maps, he said, "would tend to overestimate the flood threat. For purposes of evacuation, where you are trying to portray what could be the worst case, that's not that bad. But if you apply that reasoning to flood elevations for the FEMA model, it's totally different. If you build your house, and (the model shows) flooding is higher, you'll have higher rates and people are going to complain much more."

National Weather Service SLOSH modeler Wilson Shaffer defends the general accuracy of the program. But, he said, "given the choice of over- or underestimating, I would rather err on the side of overestimating what it is. The results of underestimating could be disastrous."

Such differences aren't unexpected. "The models are all trying to do the same thing," Suhayda said. "It's just different approaches. In that sense no model is perfect; each one has to make those compromises."

## Improving the grid

One of the biggest problems in storm-surge modeling is that the grid used to represent a given landscape is often crude, with points sometimes a mile or more apart. Flooding critical to the New Orleans area, such as levee overtopping or water in the streets, takes place on a much smaller scale.

AdCirc uses a mathematical technique common in computerized engineering, crash testing and 3-D animation. It creates a "mesh" of triangular cells that represents the landscape and a more precise mathematical technique to calculate surge dynamics. Recent advances have let programmers create a very fine mesh, with points only a few hundred feet apart, in areas such as New Orleans, while leaving a looser mesh on the open water. That way the computer focuses on the areas that count.

"It's providing lots of detail," Westerink said. "About 90 percent of the computational time is spent on south Louisiana, but the grid spreads out to the entire Gulf."

As computer power grows, the models get better and also deal with new challenges. "The models are evolving," Westerink said. "Any model that stagnates, it's not good. In the 1970s we were doing computational models that had several hundred points. Now we're in the millions." But as the scale gets finer, new questions come up. For example, AdCirc modelers are studying in detail how to represent water flowing over a weir or a levee, a fine detail not seen before.

Current surge models also don't account for the smaller waves that run on top of the large surge wave. Doing so would involve complex calculations, because waves depend not only on winds but on currents and water depth. But waves do plenty of the damage in a flood, so generating a model that accounts for waves may be the next big advance in storm-surge modeling.

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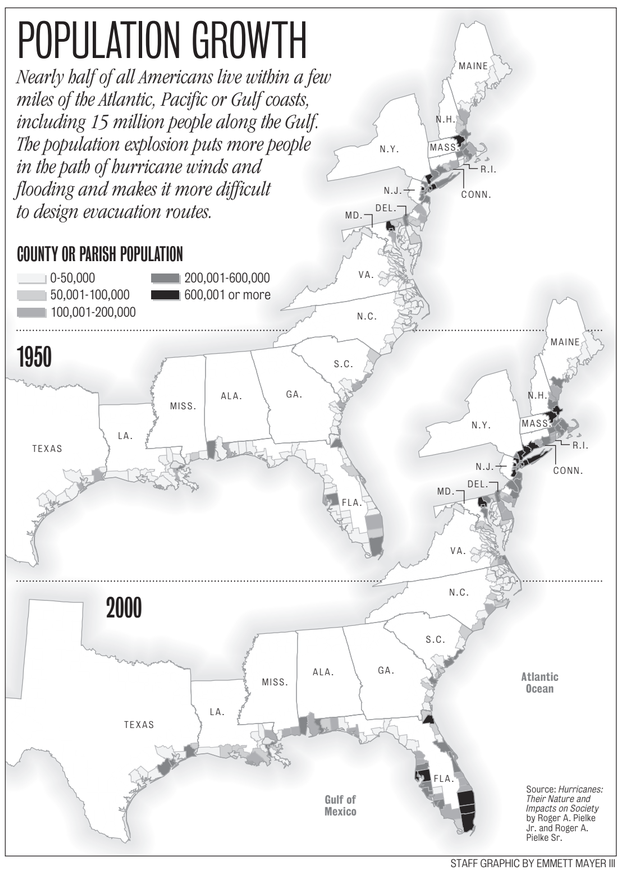
STAFF PHOTO BY ELLIS LUCIA

While canals, such as the Houma Navigational Canal, have facilitated navigation throughout south Louisiana, they have decimated wetlands and accelerated erosion. In fact, one of the weaknesses of storm modeling is that some models can't take into account the disappearing coastline. With the coast in flux, scientists have trouble accurately predicting the intensity and characteristics of oncoming storms.




STAFF GRAPHIC BY EMMETT MAYER III

# Next crisis will test federal relief response

**DISASTER,** *from A-13*

administration restructured FEMA after a poorly coordinated federal response to Hurricane Andrew in Florida drew complaints from disaster victims. Recognizing that a quick and well-coordinated response to future disasters would bring practical benefits and political rewards, Clinton beefed up the agency's budget and refined its mission.

The federal role in disasters expanded still further, and with it the number of requests for disaster aid. From 1977 through 1981, the average number of presidential disaster declarations — which open the spigots of federal aid — was 25 per year. For the five years ending in 2001, that number had doubled to 50 per year. Some critics say the bar on what qualifies as a disaster has effectively been lowered, though the fact that there is more vulnerable real estate also plays a role.

Critics say federal policies stressing relief over disaster prevention have encouraged development in dangerous areas.

"The intent of these (disaster-relief) laws was not just to help victims who through no fault of their own are in the way of disasters," said University of Massachusetts geography and planning law professor Rutherford Platt, "but also to try to limit the exposure of new development and population to hazards.

"But in the last 15 years, the emphasis has been increasingly on helping the victims with much-publicized disaster declarations, and pulling back on sensible land-use planning and other solutions," he said.

Though FEMA's role as a taskmaster coordinating the emergency response of multiple agencies improved, disaster programs themselves have not been streamlined. The legacy of haphazard changes in the past several decades, disaster relief is the responsibility of at least 16 distinct programs in different departments. For reformers trying to track the federal role in disasters, it's almost impossible to get a total for the amount spent annually. Many individual programs, such as FEMA's flood-plain mapping and the Interior and Agriculture departments' fire-prevention efforts, are in disarray.

The system also makes most disaster-prevention grants available to communities only after they've suffered a disaster, something experts say gets it backward.

The disappearance of the federal budget surplus and the ongoing threat of large terrorist attacks have raised an alarming issue: The federal budget can ill afford a string of major disasters that cost tens of billions of dollars or more. State budgets, currently in a fiscal crunch, are ill-prepared to pick up the slack.

"The nut I'm out to crack is 'it's not going to happen here,' because it will," University of Colorado disaster sociologist Dennis Mileti said. "In San Francisco, we're looking at a quarter-of-a-trillion-dollar earthquake. If Andrew made a direct hit on Miami or New Orleans, we're talking something similar. We had a $100 billion earthquake in Kobe (Japan, in 1995). There didn't used to be disasters that big. Now there are."

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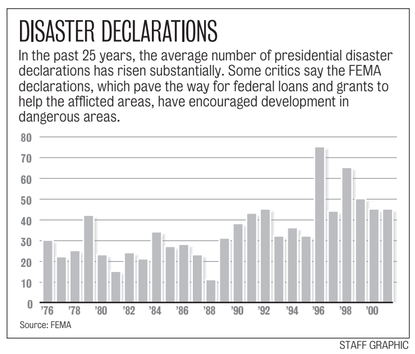


STAFF GRAPHIC

## AGENCIES

In the event of a disaster, the Federal Emergency Management Agency coordinates the federal response, working with 27 federal agencies and the American Red Cross to provide emergency food and water, medical supplies and services, search and rescue operations, transportation assistance, environmental assessment and other needs. For hurricanes, the key agencies include:

**FEMA** coordinates relief efforts and funnels money for various individual and public agency grants.

**THE PUBLIC HEALTH SERVICE** coordinates volunteer teams providing medical assistance and mortuary services.

**THE AMERICAN RED CROSS** operates shelters and handles other mass-care responsibilities. It also staffs postdisaster offices where victims can apply for aid.

**THE ENVIRONMENTAL PROTECTION AGENCY** assists in controlling associated environmental problems, such as chemical spills.

**ARMY CORPS OF ENGINEERS** assists in providing pumps, emergency generators and drinking water, as well as possibly blowing up levees to remove water from the city.

**THE SMALL BUSINESS ADMINSTRATION** offers low-interest loans to individuals and businesses.

In Louisiana, each parish has its own emergency preparedness office that directs initial disaster response efforts. At the state level, the Louisiana Office of Emergency Preparedness coordinates the response of state agencies and the National Guard.

Before FEMA and other federal agencies can provide financial assistance, the governor must request their aid and the President must declare a major disaster or emergency. While the process can seem bureaucratic, in recent years FEMA has helped speed it along.

When it appears the effects of a hurricane will be beyond state and local capacity, the state Office of Emergency Preparedness will ask FEMA to conduct a joint preliminary damage assessment, which will include state and local representation.

Using that information, the governor submits a request to the president through the FEMA regional director in Fort Worth for the declaration. The FEMA regional office passes on its recommendation to FEMA's national staff, which decides whether to pass it on to the president.

The formal declaration can take several days. In the meantime, however, FEMA will have dispatched various federal agencies to provide relief. The American Red Cross, named by Congress as a participant in all disaster responses, also will already be mobilizing its forces, as will other volunteer relief agencies, such as the Salvation Army.